REMARKS

Claims 1, 5 and 6, all the claims pending in the application, are rejected. Claims 1, 5 and 6 are amended.

Support for these amendments are found in the disclosure of the original specification, in particular:

> "a layer, on said ferromagnetic layer, having no granular structure and comprising a material selected from a group consisting of CoCrPt, CoPt, CoPd, FePt, $CoPt_3$, and $CoPd_3$"

in amended claims 1 and 6 from the description on page 8, lines 25 to 27 and the description on page 17, lines 6 to 9; and

> "said perpendicular magnetic recording disk comprising, on said substrate, said soft magnetic layer, said ferromagnetic layer having the granular structure, and said layer having no granular structure in this order"
>
> in the amended claims 1 and 6, from Fig. 1 and the description on page 8, lines 25 to 27.

Specification

Claim 1 is objected to because a misspelled word occurs in claim 1, Line 5 (gains, should be grains). Appropriate correction has been made.

Claim Rejections - 35 USC § 103.

Claims 1, 5 & 6 are rejected under 35 U.S.C. 103(a) as obvious over Kikitsu et al. (US 6,830,824). This rejection is traversed for at least the following reasons.

Amended Claim 1

Claim 1 has been amended to emphasize the structure of the claimed perpendicular magnetic recording disk having specific granular and non-granular layers that are combined in a specific order to solve a significant problem in the art that has not been addressed by the prior art.

Problems Solved

In defining the problems confronted by the present inventors and overcome by the invention, the inventors teach in paragraph [0006] (i.e. page 3, line 16 through page 4, line 3) of the original specification:

> "By adding an oxide such as SiO_2 to the CoPt-based perpendicular magnetic recording layer, the oxide such as SiO_2 is segregated at the grain boundaries to reduce the magnetic interaction between the crystal grains of the magnetic recording layer. Further, by the addition of the oxide such as SiO_2, the crystal grain size can be reduced. By increasing the amount of SiO_2 added to the magnetic recording layer, the S/N ratio in high density recording is improved."

Further, as described in paragraph [0007] (i.e. page 4, lines 4-21) of the original specification, the inventors note a barrier in teaching that:

> "However, when aiming at a medium adaptable to 400Gbit/inch^2 or more, it is difficult to produce the medium excellent in thermal stability or recording properties only by adding the oxide such as SiO_2. That is, when, for example, the amount of SiO_2 is increased to 6at% or more, degradation occurs in coercive force Hc. Due to such reduction in coercive force Hc, the thermal stability degrades and the DC noise increases. On the other hand, as the amount of SiO_2 increases, the SNR (SN Ratio) becomes better."

Features of the Claimed Invention

The invention defined by amended claim 1 applies a specific structure to effectively increase the recording density by (1) improving the S/N ratio in high density recording without (2) causing an increase in DC noise and (3) causing degradation in thermal stability ((paragraph [0008] (i.e. page 4, line 22 through page 5, line 7) and paragraph [0024] (i.e. page 13, lines 5-9 from the bottom) of the original specification)).

More specifically, the invention uses the arrangement recited in the amended claim 1 of a ferromagnetic layer having a granular structure and a layer, on the ferromagnetic layer, having ***no*** granular structure and comprising a material selected from a group consisting of CoCrPt,

CoPt, CoPd, FePt, $CoPt_3$, and $CoPd_3$ to thereby increase the recording density by (1) improving the S/N ratio in high density recording without (2) causing an increase in DC noise and (3) causing a degradation in thermal stability.

In fact, it is described in page 17, lines 1 to 13 of the original specification that:

> "it had a granular structure. Specifically, it was confirmed that grain boundary portions made of Si oxide were formed between crystal grains of the hcp crystal structure containing Co. It was found from this analysis that the ferromagnetic layer 5 was made of the magnetic grains of about 6nm and the boundary regions made of the nonmagnetic bodies of about 2nm. On the other hand, the stacked layer 7 being the layer above the ferromagnetic layer 5 having the granular structure was analyzed in detail by the use of the TEM and it ***did not have*** a granular structure. This represents that the stacked layer 7 has a structure being substantially continuous magnetically. That is, this represents that the magnetic grains of the ferromagnetic layer 5 of the granular structure are magnetically coupled through the stacked layer 7. It is considered that this improves the thermal stability."

Inasmuch as the perpendicular magnetic recording disk comprises, on the substrate, the soft magnetic layer, the ferromagnetic layer having the granular structure, and the layer having no granular structure in this order, the layer having ***no*** granular structure is disposed above the ferromagnetic layer having a granular structure as seen from the substrate. The arrangement in which the layer having ***no*** granular structure is disposed above the ferromagnetic layer having a granular structure, as seen from the substrate is preferable in view of HDI (Head Disk Interface) (page 9, lines 20-22 of the original specification).

The arrangement in which the layer having ***no*** granular structure is disposed above the ferromagnetic layer having a granular structure as seen from the substrate, also provides a new effect that glide characteristics and flying characteristics are improved. As regards the new effect, it is described in page 16, lines 11-20 of the original specification that

> "Through the manufacturing process as described above, the perpendicular magnetic recording disk of this example was obtained. The surface roughness of

the obtained perpendicular magnetic recording disk was measured by the AFM in the same manner and it was a smooth surface shape with Rmax being 4.53nm and Ra being 0.40nm. By forming the spacer layer 6 and the stacked layer 7, the surface roughness Rmax and Ra are improved. The surface roughness is further improved by increasing the number of cycles of CoB and Pd of the stacked layer 7. This also provides a new effect that glide characteristics and flying characteristics are improved so that the thickness of the protective layer can be reduced."

Kikitsu et al:

Kikitsu et al does not disclose the arrangement recited in the amended claim 1 of a ferromagnetic layer having a granular structure and a layer, on the ferromagnetic layer, having ***no*** granular structure and comprising a material selected from a group consisting of CoCrPt, CoPt, CoPd, FePt, $CoPt_3$, and $CoPd_3$.

Kikitsu et al also does not disclose that the perpendicular magnetic recording disk comprises, on the substrate, the soft magnetic layer, the ferromagnetic layer having the granular structure, and the layer having ***no*** granular structure in this order.

Kikitsu et al describe, on col. 8, line 26 through col. 9, line 20, the structures common with all of the embodiments of Kikitsu et al. Each of the embodiments of Kikitsu et al has a base layer and/or a switching layer and/or a functional layer that are interposed between a nonmagnetic substrate and a magnetic recording layer (col. 8, lines 33-37).

The recording layer has a structure in which magnetic particles (Co) are dispersed in a nonmagnetic material (SiO_2) (col. 8, lines 49-50, 55 and col. 9, line 19).

Kikitsu et al disclose, in Fig. 5 which shows the second embodiment (col. 15, lines 7-10) and the third embodiment (col. 17, lines 1-5), that an underlayer 12, a base layer 13, a recording layer 15 and a protective layer 16 are formed in the order mentioned on the substrate 11 (col. 15, lines 10-14). Kikitsu et al also disclose in Example 6 (col. 49, line 10 through col. 51, line 21) exemplified as the third embodiment shown in Fig. 5, the base layer is constructed such that columnar magnetic crystal grains of CoPtCr are separated from each other by the nonmagnetic

portion of the amorphous SiO_2 (col. 51, lines 11-14). As described above, the recording layer has a structure in which magnetic particles (Co) are dispersed in a nonmagnetic material (SiO_2) (col. 8, lines 49-50, 55 and col. 9, line 19). Thus, in Kikitsu et al, the recording layer on the base layer has also a granular structure. Kikitsu et al does not disclose a layer having ***no*** granular structure on the ferromagnetic layer having a granular structure.

Kikitsu et al disclose in Fig. 21 (which shows the eighth embodiment) that an underlayer 102, a functional layer 103 comprising a magnetic material, a recording layer 104 and a protective layer 105 are formed on the substrate 101 in the order mentioned (col. 34, lines 5-11).

Although Kikitsu et al disclose on col. 43, lines 46-55 that the recording layer and the functional layer of the eighth embodiment are exemplified, the functional layer 103 and the recording layer 104 are formed on the substrate 101 in this order in Fig. 21 (the eighth embodiment) in the manner described above. Inasmuch as the functional layer 103 and the recording layer 104 are formed on the substrate in this order in the eighth embodiment of Kikitsu et al, the recording layer is formed **before the grains** are coarsened in accordance with the growth of the functional layer, with the result that it is possible to suppress the stress moderation or the stress generation so as to prevent the grain sizes from the being increased (col. 41, line 58 through col. 42, line 2). This merit is in marked contrast to the merits of this invention described in Features of the Claimed Invention. Thus, Kikitsu et al does not disclose a layer having ***no*** granular structure on the ferromagnetic layer having a granular structure.

As described above, Kikitsu et al does not disclose the arrangement recited in the amended claim 1 of a ferromagnetic layer having a granular structure and a layer, on the ferromagnetic layer, having ***no*** granular structure and comprising a material selected from a group consisting of CoCrPt, CoPt, CoPd, FePt, $CoPt_3$, and $CoPd_3$. Kikitsu et al never discloses that the perpendicular magnetic recording disk comprises, on the substrate, the soft magnetic layer, the ferromagnetic layer having the granular structure, and the layer having ***no*** granular structure in this order.

Because of the absence in the prior art of critical claim limitations related to the presence and/or absence of granular structures, Applicants respectfully submit that amended independent claim 1 is patentable.

Claim 5

This claim would be patentable due to its dependence on parent claim 1, for the reasons given for claim 1.

Claim 6

Likewise, Applicants respectfully submit that independent claim 6, which has been amended in a manner consistent with claim 1 in order to emphasize the granular and non-granular structures of the component parts, is also patentable.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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